Reference #4

MBG-80

GROUNDWATER CONDITIONS NEAR THE TRI-CITIES LANDFILL

prepared for
Maricopa Association of Governments
208 Program

by

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January 15, 1980

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The purpose of this report is to provide background information on groundwater conditions near the Tri-Cities landfill, which is located in the north half of section 34, T2N/R5E, north of Mesa, Arizona. Based on this information and other factors, the suitability of the site for a landfill can be determined.

Subsurface Geology

Two predominant geologic units have been penetrated in the subsurface by wells in the vicinity. The uppermost unit, or Recent alluvium, consists primarily of unconsolidated boulders, gravel, and sand and extends to a depth ranging from about 140 to 180 feet. The underlying, or basin-fill deposits, are generally fine-grained and contain more clay and silt than the Recent alluvium. The predominant clays characteristic of the "Middle Fine-Grained Unit" of the U.S. Bureau of Reclamation (1977) are apparently not present beneath the landfill, as the northernmost edge of this unit is believed to be almost two miles south of the site. More consolidated materials have been penetrated by wells at depths ranging from 500 to 800 feet in the vicinity. However, the "Lower Conglomerate Unit" of the U.S. Bureau of Reclamation apparently has not

been penetrated by wells in this area.

Drillers logs are available for two wells within one-half mile of the landfill. The log for well (A-2-5)34ccb, southwest of the landfill and 371 feet deep, indicates very coarse-grained material to a depth of about 160 feet. Alternating coarse and fine-grained strata are present below this depth. Fine-grained materials were encountered in the following depth intervals: 160 to 220, 245 to 310, and 330 to 355 feet. The log for well (A-1-5)2bbb2, southeast of the landfill and 822 feet deep, indicates very coarse-grained material to a depth of 175 feet. Alternating coarse and fine-grained strata are present below this depth. Fine-grained materials were encountered in the following depth intervals: 170 to 280, 335 to 515, and 585 to 820 feet. The uppermost fine-grained strata present at both wells have the potential for perching groundwater above the main water level, which is now at a depth exceeding 200 feet.

Water Levels

Depth to water in January 1979 was 216 feet at well (A-1-5)5aaa, one and one-half miles southwest of the landfill. Depth to water at this time was 255 feet at well (A-1-5)2bbb2, one-half mile southeast of the site. The projected depth to water beneath the landfill in January 1979 was about 230 feet below ground surface. Intensive water-level measurements were made in Spring 1972 and the U.S. Bureau of Reclamation (1977)

prepared a water-level contour map indicating the direction of groundwater flow at that time. The direction of groundwater flow in Spring 1972 was to the southeast, at a slope of about twenty feet per mile. The regional direction of groundwater flow in the vicinity is largely controlled by large-scale pumpage from Salt River Project wells southeast of the landfill and recharge from flood flows in the Salt River.

Water level hydrographs for wells in the area show substantial water level declines since the 1950's. For example, at well (A-1-5)5aaa, water levels dropped from 133 feet in 1957 to about 235 feet in 1965. In large part this was due to dewatering of the highly permeable Recent alluvium. Since 1965 water levels have remained relatively constant, rising during and following flood flows in the Salt River and falling during prolonged periods of no flow. Large flows were present in the Salt River during the following months since 1941:

December 1965 - January 1966
March - May 1973
March 1978
December 1978 - April 1979

The depth to water in well (A-1-5)5aaa rose about twenty feet during the flood flows of 1978-79. Water levels in well (A-1-5)2bbb2 rose about 20 to 25 feet after the flood flows of 1978-79. Thus the January 1979 water-level measurements are as shallow as can be expected under present conditions. A regional perched zone is present west and south of the landfill, however present data indicate that this

zone is not present near the Salt River, east of Alma School Road. This may be because of the absence of the "Middle Fine-Grained Unit" in this location.

Recharge and Discharge

Wilson, Cortner, and DeCook (1979) discussed recharge in the East Basin of the Salt River Valley. Substantial recharge has occurred from flood flows in the Salt River and additional recharge comes from deep percolation of irrigation water. There is little pumpage north of the Salt River near the landfill. Much of the pumpage for gravel processing at several plants near the landfill percolates back to the groundwater after use. There is substantial pumpage south and east of the landfill from large-capacity irrigation wells.

Aquifer Characteristics

Twenty-four hour pump tests were conducted on eight SRP wells in the landfill vicinity during Summer 1979 (Table 1). Transmissivities were determined from recovery water-level measurements over a period of about four hours. Specific capacities for most wells ranged from about 110 to 200 gpm per foot of drawdown. Transmissivities for most of the tests ranged from about 300,000 to 520,000 gpd per foot of aquifer width. These relatively high values reflect the excellent production potential of the coarse-grained strata present beneath the Recent alluvium. Based on an average water-level

TABLE 1 - RESULTS OF 1979 PUMP TESTS FOR
WELLS IN THE TRI-CITIES LANDFILL VICINITY

Well	Perforated Interval (feet)	Discharge (gpm)	Specific Capacity (gpm/ft)	Transmissivity (gpm/ft)
(A-1-5) 2aaa2	350-1,110	2,650	204	494,000
2bbb2	822 T.D.	2,850	124	396,000
2cbb2	200-800	2,490	149	518,000
2cdd2	300-988	3,920	164	346,000
2dbb	350-1,082	3,020	170	347,000
2ddc	290-673	3,900	165	297,000
3ddc	200-480	2,840	80	203,000
4ddd2	300-772	3,680	109	347,000

Pump test data from the files of the Arizona Water Commission, Salt River Valley Groundwater Model Study (1980).

slope of twenty feet per mile, an estimated porosity of 0.40, and a permeability of 600 gpd per square foot, the rate of groundwater flow is calculated to be about 300 feet per year.

Groundwater Use

Figure 1 shows the location of wells in the vicinity. Most wells are used for irrigation or industrial use, although there is some limited use for drinking water.

Water Quality

Table 2 contains the results of chemical analyses of water from selected wells in the vicinity. Groundwater in the vicinity of the landfill is of the sodium chloride type, with relatively low nitrate contents. Total dissolved solids contents range from about 550 to 690 mg/l. The chemical quality of this groundwater is indicative of recharge from Salt River flood flows. Shallower groundwater appears to be of somewhat higher salinity. Results for well (A-2-5)22bcb, a well located almost two miles northwest of the landfill indicate that groundwater in that area is also of the sodium chloride type. However, total dissolved solids content is 1,160 mg/l and the nitrate content exceeds the drinking water limit of 45 mg/l. Recharge to groundwater in this area may largely come from irrigation return flow.

In August 1979, as part of the previously mentioned pump testing program, water samples were collected from

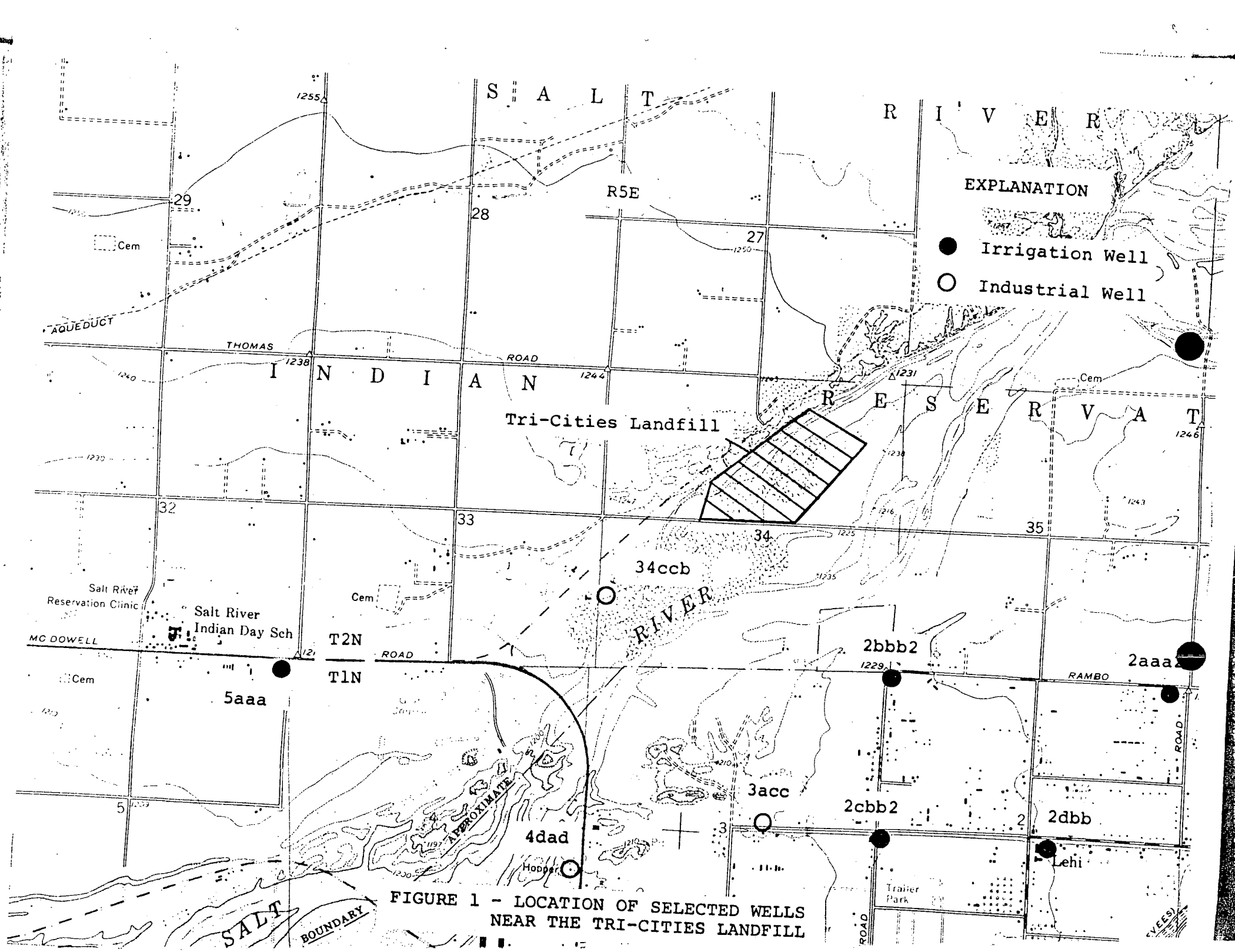

FIGURE 1 - LOCATION OF SELECTED WELLS NEAR THE TRI-CITIES LANDFILL

TABLE 2 - CHEMICAL ANALYSES OF WELL WATER IN THE VICINITY OF THE TRI-CITIES LANDFILL

Constituent (mg/l)	(A-1-5) 2aaa2	2dbb	2cbb2	3ddc	4ddd2	(A-2-5) 22bcb
Calcium	48	53	57	64	64	113
Magnesium	9	13	17	15	18	50
Sodium	154	173	176	182	148	210
Carbonate	0	0	0	0	0	0
Bicarbonate	201	250	232	227	190	217
Sulfate	29	29	33	37	25	135
Chloride	204	231	248	270	259	394
Nitrate	7	14	14	11	4	52
Fluoride	-	-	-	-	-	0.2
Hardness (CaCO3)	159	167	210	223	234	489
Electrical Conductivity (micromhos @ 25°C)	1,000	1,170	1,170	1,240	1,110	-
Total Dissolved Solids	553	636	659	691	612	1,160
pH	7.9	8.1	8.3	8.4	7.8	7.4
Date	2/13/69	11/7/69	10/27/69	10/27/69	6/5/69	7/7/76
Lab	SRP	SRP	SRP	SRP	SRP	ATL
Perforated Interval (feet)	350-1,110	350-1,082	200-800	200-480	300-772	325-800

Data from U.S. Geological Survey computer printout for the East Basin of the Salt River Valley and from files of Indian Health Service, Phoenix, Arizona.

numerous SRP wells in the vicinity of the landfill. Field measurements were made by personnel of the U.S. Geological Survey and laboratory analyses by the Arizona Department of Health Services. A number of constituents, such as trace elements, were determined which had not been previously analyzed in water from these wells. This information thus supplements that in Table 2. The results of the 1979 sampling indicate that the field pH ranged from 7.3 to 7.4, and the electrical conductivity ranged from about 1,050 to 1,250 micromhos per centimeter at 25°C. Fluoride contents usually ranged from 0.2 to 0.3 mg/l and dissolved oxygen contents were usually about 5 to 6 mg/l. Iron, copper, manganese, zinc, chromium, cadmium, and selenium were generally present in concentrations below the detection limits. The only trace element that was present at noticeable levels was arsenic. Arsenic contents ranged from 0.008 to 0.014 mg/l and appear to increase toward the landfill. However, supplementary sampling is necessary to fully interpret the arsenic distribution in groundwater. Such contents are apparently common in some other parts of the valley, due to natural factors. These values are well below the EPA maximum contaminant level for drinking water of 0.05 mg/l.

As part of this investigation, water samples were collected from three wells used for gravel processing: (A-1-5)3acc, (A-1-5)4dad, and (A-2-5)34ccb. When available, the results of this sampling will be appended to this report.

Suitability of Site for Landfill

Except for the location of the landfill in the floodplain of the Salt River, the site is hydrogeologically suitable for disposal of normal domestic solid waste. If protection can be provided against floods or the landfill can be moved out of the floodplain, then it would be hydrogeologically suitable. However, all sources of water should be kept out of the landfill, including liquid wastes. The site or nearby sites are not hydrogeologically suitable for the disposal of hazardous wastes, as this location is in a prime recharge area for groundwater of the East Basin and numerous wells are located nearby.

REFERENCES

U.S. Bureau of Reclamation, 1977, "Geology and Groundwater Resources Report, Maricopa and Pinal Counties, Arizona", Central Arizona Project, Paradise Valley-Chandler-Queen Creek Subarea.

Wilson, L.G., Cortner, H.J., and K.J. DeCook, 1979, "Plan of Study for a Demonstration Recharge Project in the Salt River Valley", Draft Technical Appendix, Phoenix Urban Study Final Report, U.S. Army Corps of Engineers.